

Forest Roads

Proper road construction will minimize disturbance to waterflow over the landscape and ensure the longevity and stability of the road. Forest roads provide a simple road structure of adequate strength to support heavy vehicle traffic while providing adequate drainage to allow water to pass through the road corridor.



BMPs for forest roads are designed to provide greater opportunities for safe, efficient and profitable operations. A well-planned and properly constructed forest road is necessary to effectively protect the forestland and water quality when removing forest products from the harvest site.

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Site characteristics and the value of the resource being served will influence choices regarding road construction standards and maintenance activities. Culverts and ditches may be necessary in many situations.

Well-drained and properly surfaced forest roads prevent erosion and provide better wet weather harvesting access. This will, in-turn, provide more operating days for the logging contractor.

Road Alignment and Location

The proper alignment and location of roads will reduce the potential for non-point source pollution. The following recommendations should be incorporated in the road design:

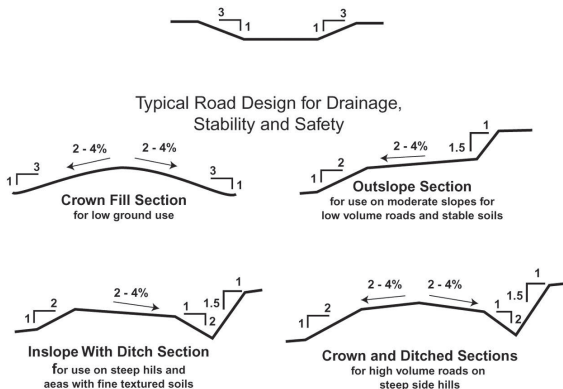
- Roads should follow contour as much as possible with grades between 2% and 10%. Steeper gradients may be necessary due to boundary lines or SMZ restrictions; in these cases, additional BMP measures may be required.
- Forest roads should be out-sloped wherever road gradient and soil type will permit.
- Use in-sloping or ditch-and-culvert type of cross-section when constructing a road where road gradients exceed

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15%, toward sharp turns, or when constructed on clay and/or slippery soils. Cross-drainage culverts should be incorporated in this instance.

TRUCK HAUL ROADS

Typical Road Design for Drainage,
Stability and Safety



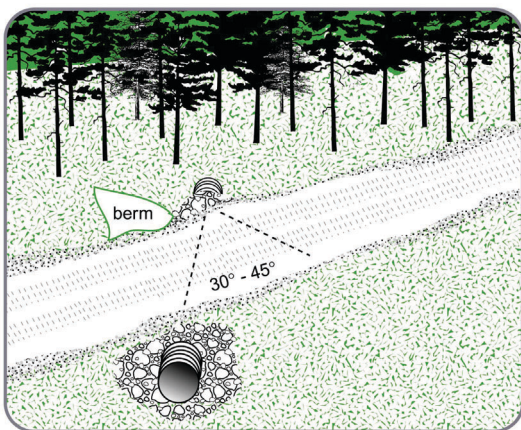
Road Drainage

Water flowing along or onto the road should be diverted before gaining sufficient volume or velocity to cause significant erosion of the road and ditch. The following recommendations should be used to minimize erosion:

- Control the flow of surface water on roads by using a combination of the appropriate road cross-section and water diversion structures within the roadbed itself.
- Install cross drains and diversion ditches to avoid carrying water long distances in roadside ditches.
- Road cross drains may include pipe culverts, rolling dips or broad based dips.
- A 15" pipe culvert is the minimum recommended size for cross drainage. Smaller culverts can clog with debris and require frequent maintenance.
- Spacing for cross drainage is critical as slope increases. Recommended spacing for cross drainage culverts is $400/\text{percent slope} + 100$ feet. (See table on page 28.)

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CROSS DITCH CULVERT

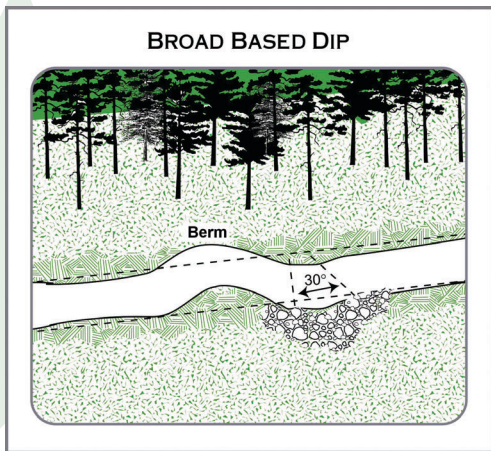


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Table 1 Suggested Spacing for Cross Drainage Culverts	
Cross Drainage Road Grade (percent)	Culvert Spacing Distance (feet)
0-2	500-300
3-4	250-180
6-10	167-140
11-15	136-140
16-20	126-120
21+	100

Table 2 Suggested Spacing for Rolling Dips	
Road Grade (percent)	Distance (feet)
2-5	180
5-10	150
10-15	135
15+	120

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- Size stream crossing culverts and other drainage structures large enough to minimize impact on water flow and water quality. For more details, see *Stream Crossing Section* starting on page 43.
- Avoid draining surface water from roads and ditches directly into streams, ponds, lakes or wetlands. Instead, drain the water into the filter strip or other vegetated area.

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Table 3
Suggested Spacing for
Broad Based Dips

Road Grade (percent)	Distance (feet)
2	300
3	235
4	200
5	180
6	165
7	155
8	150
9	145
10	140
12	135

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- Build a sediment trap into the ditch to catch debris as it travels down the ditch.

Constructing Forest Roads

Proper construction of roads is a vital step in preventing erosion. The following are some practices that may lessen the potential for problems to develop.

Clearing widths will vary depending on the needs of both the owner and the user of the road.

Consideration should be given to the necessity for roadway drying and to safety and cost of various widths of road right-of-ways.

Excavation

- Minimize cuts and fills as much as possible during design and construction.
- Tall cut slopes may require back-sloping to achieve stability and successful revegetation. Slopes of 1:1 or flatter are preferred if the terrain permits.
- Do not side cast material if there is a chance it will enter a stream channel or if side slope exceeds 60%. (Full bench construction with removal of fill material offsite may be necessary in this situation.)

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- Locate access roads outside of SMZ unless no other alternative exists.
- Deposit excess material in stable locations away from streams, ponds, lakes and wetlands.
- Avoid placing excavated material in SMZs.
- Limit the area excavated to that which can be shaped and stabilized within a day, with provisions made for storm drainage and sedimentation control.

Construction

Site drainage and cross-drainage are important for controlling sedimentation. Proper handling of water during construction will minimize potential impacts

on water quality. These recommendations should be followed to reduce possible impacts:



- Provide adequate drainage for road grades during construction to minimize erosion of unconsolidated materials.
- Install drainage structures as construction proceeds.

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- Avoid locating roads with grades in excess of 10%. On highly erodible soils, also identified on soil survey maps, a grade of less than 8% is recommended.
- Minimize down-road flow and ponding by constructing roads with a slight outsloping of 1% or 2%. Install broad based dips or rolling dips if grades are greater.



- Crown the road surface and excavate ditches where necessary.
- Compact fill firmly around culverts, paying special attention to the sides and lower portion. Cover the top of the culverts with fill to a depth of one-half the pipe diameter or 12 inches, whichever is greater.
- Use riprap or large boulders to stabilize culvert inlets and outlets to reduce bank and channel erosion and sedimentation.

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- Provide temporary cross-drainage structures such as water bars during construction where needed to drain water off road surfaces.
- Install siltation barriers such as silt fences and straw bales during construction on sites where roads and water have close contact for long periods.

Soil Protection

Disturbed areas should be shaped, stabilized and, if necessary, seeded as soon as possible to minimize the potential for erosion. The greatest potential for soil erosion occurs immediately after construction.



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The following measures are recommended:

- Vegetative cover is recommended along all forest roads. To prevent erosion before vegetation takes hold, mulch with hay, straw, bark or native vegetation. Hay or straw mulch should be applied at the approximate rate of 80 bales per acre.
- Inspect and repair erosion control measures on a regular basis to insure that they remain functional.

Designing Wetland Forest Roads

Timber operators are strongly advised to use the services of a professional forester to design wetland forest roads. This professional assistance is particularly important when constructing permanent all-season roads.

The following general recommendations apply when planning the design of all roads across wetlands:

- Avoid crossing wetlands if possible.
- Minimize total wetland road mileage when wetlands must be crossed.
- Determine the type and depth of wetland subsoil to ensure proper design and construction.
- Minimize width of roads consistent with maintaining safety and road design considerations. This typically

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would be a running surface of 12 feet in width for straight sections, and the curved road running surface would be no wider than 16 feet.

- Design approaches to wetlands so that surface runoff carrying potential sediment is diverted before entering the wetland.
- Plan to remove temporary fills and structures to the extent practical when use is complete.
- Provide adequate cross-drainage by employing one or both of the following techniques:
 - Use construction methods that allow free water flow throughout the entire roadbed; or
 - Place 24" culverts or other cross-drain structures at regular intervals across the fill material throughout the wetland road. These culverts should have one-half their diameter placed below ground level to handle sub-surface flow.

Constructing Wetland Forest Roads

Choosing the appropriate road construction technique will depend on knowledge of water table position, zone of water flow, type of wetland soils, and the strength of wetland soils.

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With any road construction technique, culverts or ditches (or both) may be necessary.

Follow these recommendations when constructing ditches on wetland roads:

- Construct all road embankments with clean fill and other suitable materials.
- Construct ditches in wetland crossings, where necessary, to intercept and carry surface and subsurface water (the top 12 inches) to, through, and away from culverts.
- Avoid having ditches create outlets that will result in drainage of the wetland (*which is illegal*).

Employ sediment control techniques such as straw bales and silt fencing to prevent movement to open water when placing fill during construction.

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